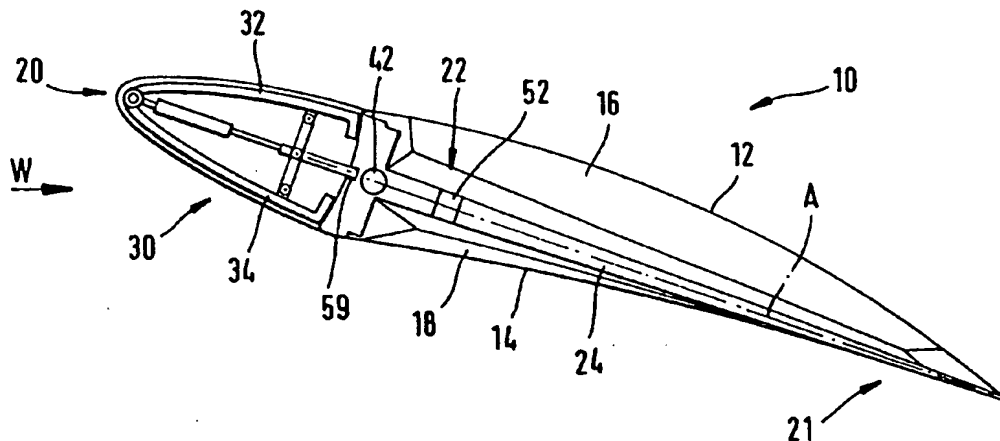




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(54) Title: FLOW BODY



(57) Abstract

A flow body with a hull (10) is provided with a steering or guiding apparatus consisting of shape-changeable side wall parts (12, 14) and an adjusting device (22) for adjusting the shape of the side wall parts (12, 14). The flow body is adjustable by the side wall parts (12, 14) with respect to its longitudinal plane (A) into an unsymmetrical, preferably wing profile shape, by which it becomes steerable. The side wall parts (12, 14) preferably consist of outer sides of opposed lateral chambers (16, 18) which are connected to one another. Different wing profiles are adjustable via different chamber volumes.

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FLOW BODY

Description

5 Technical Field

The invention relates to a flow body in accordance with the preamble of claim 1.

10 Background Art

Such a flow body in form of a flap has already become known for use in an apparatus for utilizing hydromechanical energy from DE 34 40 499 A1, to which closer reference is made below.

Flow bodies such as the hulls of ships can be guided during their movement in the water by a rudder serving as a guiding apparatus. By displacement of the rudder with respect to the longitudinal plane of the body the flow impinges on the rudder, which leads to a unilateral increase of the flow resistance of the combination of hull and rudder, thus making the hull turn in the water. The increase of the flow resistance, however, leads to an undesirable reduction of the speed and thus to a waste of kinetic energy.

In the apparatus known from the above-mentioned DE 34 40 499 A1 the flow body usually stands inclined in a flowing watercourse. The flow body substantially consists of a rotatable flap and a control fin swivellably attached at its end situated downstream, which forms a guiding apparatus. The impingement of the flow on the flap and the control fin leads to a rotation thereof, which is used for generating energy. In this known apparatus only the force is used for generating energy which is generated by the impingement of the flow on the flow body situated inclined with respect to the flow. The flow resistance produced by the flow body is relatively high, as in a rudder.

der, although only relatively little energy is obtained. Under low flow speeds, in particular, the apparatus does not have a particularly high efficiency.

5 The DE utility model 7802290 relates to a rudder or a fin which is attached as an annex to a body of a water or air vehicle. The rudder consists of a carrying structure or an elastic skin encompassing the structure which limits a hollow chamber. By activating the rudder the skin is den-
10 ted on one side in the manner of a airfoil wing and the opposite side is dented outwardly. This known rudder has a lower flow resistance than usual rudders with rigid control surfaces. Nevertheless, this known rudder also leads to the fact that on displacing the rudder the whole
15 flow resistance of the combination of body (i.e. flow body) and rudder is increased substantially and leads to an undesirable reduction in speed and thus to a waste of kinetic energy.

20 Disclosure of Invention

It is the object of the present invention to improve a flow body in accordance with the preamble of claim 1 in such a way that it becomes more easily steerable or
25 guidable and nevertheless has a lower flow resistance and that by the steering or guiding less energy is consumed. Its use in utilizing hydromechanical energy is to provide the flow body with a higher efficiency.

30 The object is achieved in accordance with the invention by the features of claim 1.

The flow body in accordance with the invention, which is provided with a body with two opposite side wall parts,
35 does not require a separate rudder as a guiding apparatus. Owing to the changeability of the shape of its outer side wall parts the flow body can be provided with an unsymmetrical shape by means of an adjusting device, which leads to a rotation of the whole body. The body thus

steers or guides itself in the water by the change of its shape per se and can be curved by the adjusting device as required, so that it maintains a shape beneficial to the flow and thus provides little resistance to the water. It is also possible to provide individual side wall parts with a changeable shape and to provide others non-changeably. The transition between shape-changeable side wall parts and non-shape-changeable side wall parts should always be continuous, so that vortices will not arise and thus flow losses are kept to a minimum.

The principal difference of the invention with respect to the state of the art in accordance with the above-mentioned DE utility model 78 02 290 is that no rudder is attached to the flow body in accordance with the invention. A novel guiding apparatus is integrated in the flow body by the invention and it is not attached like a rudder. The guiding apparatus integrated in the flow body uses side wall parts of the hull of the flow body which are changeable in shape. The adjusting device can be used to widen and constrict the inner hollow chamber differently, so that the flow body receives an unsymmetrical form with respect to its longitudinal axis and thus guides itself in the flow. The flow resistance of the flow body is very low during the guidance, as a rudder or the like which is subject to impingement of the flow is avoided and becomes unnecessary.

Preferable embodiments of the invention are formed by the subject matters of the subclaims.

In the embodiment of the invention in accordance with claims 2 and 3 the side wall parts are adjustable in such a way that the body is provided with practically continuously adjustable different wing profiles. Owing to the arrangement of the flow body as a wing profile the flow resistance is reduced considerably.

In the embodiment of the invention in accordance with

claim 4 the lifting effect of a wing profile is used for guidance. The wing profile is provided with a right and a left side wall part with different curvatures. This results in different pressures on the side wall parts of the wing profile in a flow, so that the shape of each side wall part results in a pressure or suction side of the wing profile, depending on the desired guiding direction. The pressure difference in the side wall parts of the flow body supports additionally the guiding movement of the flow body, which is a result of its unsymmetrical shape per se. In this way an easy guidability of the flow body with the lowest possible flow resistance is enabled in accordance with the invention.

15 The shape-changeable side wall parts may consist of several rigid parts composed in the manner of segments, which by means of a suitable adjusting device such as servomotors can form different overall shapes.

20 It is particularly advantageous if in the arrangement of the invention in accordance with claim 5 the shape-changeable side wall parts are flexible and thus the smoothest possible shape of the overall body is maintained in this manner. For the guidance of the flow body in accordance with the invention it is not required that the whole body in its entirety is shape-changeable. It is sufficient if there are shape-changeable side wall parts. The flexible side wall parts could extend, for example, belt-like around the hull and be provided with a low height.

35 In the embodiment of the invention in accordance with claim 6 the shape-changeable side wall parts form the outer sides of chambers which are parts of the body. The adjusting device can expand and constrict the chambers in a different manner and thus form their outer sides differently.

This can be made in the embodiment of the invention in

accordance with claim 8 by a pneumatic or hydraulic pumping apparatus.

5 The two chambers may be provided in the embodiment of the invention in accordance with claim 9 with at least one connecting conduit, through which the chamber content, preferably being air or, generally, any liquid, can flow from one chamber to the laterally opposite chamber. If
10 the flow body is situated slightly inclined to the flow, the water presses the air from one chamber into the other and thus produces a shape change in the flow body and guides it.

15 A spoiler flap, which is attached on the bow of the body in the embodiment of the invention in accordance with claim 11, can change the flow on the side wall parts additionally and facilitate the guidance, in particular when in the embodiment of the invention in accordance with claim 12 the flow is deflectable from one side wall
20 part to the other side wall part. For reasons of stability it is preferable when the spoiler flap is arranged on the bow of the body and the shape-changeable side wall parts are arranged behind the spoiler flap, i.e., in the direction towards the end of the body; within the scope
25 of the present invention, however, the reversed arrangement would also be possible.

The spoiler flap is provided so as to increase the flow resistance as little as possible, which is achieved in
30 the embodiment of the invention in accordance with claim 13 in such a way that the spoiler flap consists of two opposite outer side wall parts which are preferably not changeable and which are movable in the body on actuating the spoiler flap in the embodiment of the invention in
35 accordance with claim 14.

If the flow body in accordance with the invention is used for utilizing hydromechanical energy or if it is used itself, for example, as a rudder with a low flow resi-

stance of a common hull of a ship, the flow body is in possession of a rotational axis. Its position is adjustable in the longitudinal direction of the cross section of the body in the embodiment in accordance with claim 20, so that the ratio of the forces acting on the flow body in front of the rotational axis and behind the rotational axis is adjustable. The farther the rotational axis is arranged towards the body end, the easier it is to turn and guide it, but also the more unstable the flow body will be in the water.

The rotational axis is provided in the embodiment of the invention in accordance with claim 21 with adjustable stops so as to prevent a rotation by 180° , i.e., a complete turnover of the flow body. This is arranged in the embodiment of the invention in accordance with claim 22 in such a way that the rotational axle is adjustable in the longitudinal direction of the body cross section in such a way that under a maximum rotational angle of the flow body there prevails on it an approximate balance of moments.

To allow a change of the axial length of the side wall parts owing to the different shapes which the side wall parts can assume, at least one end of each side wall part is held axially displaceable in a positive guiding means at the body end in the embodiment of the invention in accordance with claim 23.

Brief Description of Drawings

Embodiments of the flow body in accordance with the invention are described below in greater detail by reference to the enclosed drawings, in which:

35

Fig. 1 shows a top view on a first embodiment of a flow body in accordance with the invention which is arranged as the hull of a ship;

- Fig. 2 shows a cross-sectional view of a second embodiment of the flow body in accordance with the invention, in which it can be used for utilizing hydromechanical energy in a river-run power plant;
- Fig. 2a shows an end view along the line IIa-IIa in Fig. 2;
- Fig. 3 shows the flow body in accordance with Fig. 2 in a side view;
- Fig. 3a shows the flow body in accordance with Fig. 2 in a front view;
- Fig. 3b shows a further embodiment of the flow body with several movable spoiler flaps;
- Fig. 4 shows the bow of the flow body in accordance with Fig. 2 as a detail on an enlarged scale;
- Fig. 4a shows the flow body in accordance with Fig. 2 with various positions of the actuated spoiler flap;
- Figs. 5a-5c show three successive phases of a rotation of the flow body in accordance with Fig. 2.

Best Mode of Carrying Out the Invention

- Fig. 1 shows a flow body in form of a hull 10 of a ship. The hull 10 has a right and left side wall part 12 and 14, which are spaced apart from one another and which form a hollow chamber or inner chamber of the hull. The side wall parts 12, 14 are arranged flexibly and are shape-changeable by means of an adjusting device 22 which is arranged in the hollow chamber and which is only schematically indicated in Fig. 1. The side wall parts 12, 14 and the adjusting device 22 form in combination a stee-

ring or guiding apparatus. In Fig. 1 the adjusting device 22 consists of several hydraulic cylinders, of which only one is shown. The ship is not provided with a rudder. It is steered or guided in the water by the guiding apparatus. During a straight ahead passage the side wall parts 12, 14 are adjusted by the adjusting device 22 in such a way that it results in a symmetrical cross-sectional profile with respect to a longitudinal plane A of hull 10. When hull 10 is to drive a curve to the left, the shape of the right side wall part is deformed inwardly in the direction of longitudinal plane A by an adjusting device allocated thereto and not shown in Fig. 1. Simultaneously, the adjusting device 22 allocated to the left side wall part 14 deforms it in such a way that the side wall part 14 is curved further outwardly. The flow resistance of the unsymmetrically formed hull 10 is thus different on both sides of longitudinal plane A and leads to the desired drive of the hull in a left curve. Even the smallest displacements of the side wall parts 12, 14 are sufficient for guiding the flow body without allowing it to change substantially its overall form which is beneficial to the flow.

The shape of hull 10 as shown in Fig. 2 is even more favourable to the flow. The flow body is provided here with a wing profile, i.e., it is curved stronger at its bow 20 and tapers towards the hull end 21 with a low curvature. This flow body is used in the embodiment described herein for utilizing hydromechanical energy in a river-run power plant. It consists substantially of a hull 10 which consists at its bow 20 of non-shape-changeable rigid side walls and, adjacent thereto in the direction towards its hull end 21, of a shape-changeable right side wall part 12 and of a shape-changeable left side wall part 14. In the interior of the flow body there is arranged a structure 24 in the shape of a T-beam, provided with a short flange 25 and a long bridge 26 which is at a right angle thereto and which extends in the longitudinal plane A of hull 10. Two chambers are laterally adjacent to bridge

26, i.e., a right and a left chamber 16 and 18, respectively, which consist of foldable bellows and which are filled with air. The outer sides of the chambers 16, 18 consist of shape-changeable side wall parts 12 and 14 which are made from flexible material. In the present case this is polycarbonate reinforced with glass fibres. The side wall parts 12, 14 are held axially displaceably in a form-closed guiding means 50 provided on the hull end 21, which is clearly shown in Fig. 2a. The guiding means 50 is arranged as a dovetail guiding means. In Fig. 2 the adjusting device 22 is a connecting conduit in bridge 26, through which air can flow from one chamber into the other. Chambers 16, 18 themselves are hermetically sealed with respect to the outside environment. When using the flow body in accordance with Fig. 2 as the hull of a ship, which is also possible, it is preferable when the adjusting device 22 is provided in addition to the connecting conduit 52 with a pneumatic or hydraulic pumping apparatus arranged additionally therein (depending on whether the chambers are filled with air or liquid) which pumps the air or liquid from one chamber to the other chamber and thus changes the shape of the side wall parts 12, 14.

On bow 20 there is arranged a spoiler flap 30 for changing the flow on the side wall parts 12, 14. The spoiler flap 30 consists of two outer side wall parts which are situated opposite of one another and whose shape is non-changeable. These parts are a right side wall 32 and a left side wall 34 which are connected to one another through a toggle joint or lever 40 and which are jointly rotatable about a bow axle 38.

In the side view of the flow body in accordance with Fig. 3 it can be seen that the side wall parts 12, 14 do not extend over the whole height of hull 10, but that they only form a kind of central part between the rigid parts 54, 56. The chamber 18 is provided with a valve 57, through which both chambers 16, 18 are filled with air.

Should the chambers 16, 18 fall below a certain minimum pressure after a prolonged operational period, air can be pumped in again through valve 57. The side walls 32, 34 of the spoiler flap 30 also do not extend over the whole height of hull 10, as is shown in Fig. 3a. It is possible that the side walls 32, 34 themselves, as well as the side wall parts 12, 14 themselves, are subdivided into fixed and movable parts. The latter is shown in Fig. 3b for the side wall part 12. This is subdivided into movable side wall parts 12 and 12' and a fixed side wall part 13. Hull 10 is attached on part 54, which shows towards the water surface, to a rotational axle 42, through which the movement of the flow body in the water can be transmitted to the river-run power plant and can be converted into energy. This movement of the flow body can be a translatory (into and out of the drawing plane of Fig. 3, for which a guiding means is provided which is not shown) and/or a rotary movement (about the rotational axle 42) and the rotational axle 42 may thus optionally serve as a rotary shaft. A maximum angle of rotation α is adjustable by means of adjustable stops 44, 46 on the rotational axle 42, which angle lies between 15 and 25 degrees so as to prevent a stall effect.

Fig. 4 shows the bow 20 of the flow body in greater detail. The rotational axle 42 is attachable to part 54 in various axial positions and can thus be optimized in its position depending on the flow speed of the water. The toggle joint 40 can be actuated via a control device in form of a hydraulic or pneumatic working cylinder 36 which is rotatably attached between the bow axle 38 and the toggle joint 40, as is clearly shown in the illustrations in Figs. 2, 4, 4a and 5c. A locking bolt 58, which is connected to a piston rod of the working cylinder 36, extends between the toggle joint 40 and a leading surface 28 which is situated transversally to the hull 10 and which is formed by a front surface of the short flange 25 of the structure 24 showing towards the bow 20. The locking bolt 58 snaps into a bore 59 in the leading surface

28 when it is aligned in the longitudinal plane A and thus prevents a movement of spoiler flap 30.

Fig. 4a shows two positions of the spoiler flap 30. When
5 the cylinder 36 is actuated and the locking bolt 58 disengages from the bore 59 (central position of spoiler flap 30 in Fig. 4a), the spoiler flap 30 is allowed to rotate about the bow axle 38 including cylinder 38 and thus to set approximately in the direction of flow W (the
10 position of the spoiler flap 30 turned to the right in Fig. 4a).

The function of the flow body shall be explained below by reference to Fig. 4 and Figs. 5a to 5c.

15 The direction of the flow of the water is indicated in Figs. 5a-5c by an arrow W. At the beginning of the movement of the flow body it is aligned inclined to the direction of flow W and the spoiler flap 30 is not actuated, i.e., the toggle joint 40 is stretched (Fig. 2 or
20 Fig. 4) and the side walls 32, 34 provide in combination with all other parts of the hull 10 the latter with the profile of a streamlined body which body has a low flow resistance. Owing to the inclined position of the flow
25 body in accordance with Fig. 5a, the left side wall part 14 is flowed against by the water directly and compressed inwardly in the direction of longitudinal plane A. This leads to a concave shape of the side wall part 14. The volume of the left chamber 18 is thus reduced. The air
30 thus displaced flows through the connecting conduit 52 into the right chamber 16 and increases its volume. As the structure 24 is rigid, the increase in the volume can only be brought about in that the right side wall part 12 deforms outwardly in a convex manner and is curved more
35 strongly convexly than is the case in a position of the flow body precisely in the direction of the flow W, as is shown in Fig. 2. The fact that the right side wall part 12 is provided with a convex curvature and the left side wall part 14 is provided with a concave curvature results

in different flow speeds on both side wall parts 12, 14. The side wall part 12 becomes the suction side and the side wall part 14 becomes the pressure side of the flow body which was previously streamlined and which now has the form of an airfoil. The part of the hull 10 situated behind the rotational axis 45 in the direction of the flow is thus subjected in Fig. 5a to a strong force which is directed to the right, which tends to turn the flow body counterclockwise. This force is the result, on the one hand, of the flow impinging on the left side wall part 14 and, on the other hand, of the pressure difference between side wall part 12 and 14. Between chambers 16 and 18 a pumping apparatus or the like is not required, because the flow which deforms the side wall part 14 automatically brings about the optimal wing foil profile by pressing the air into the right chamber 16 and also deforming the side wall part 12. The adjusting device 22 consists here only of the connecting conduit 52.

The force acting behind the rotational axle 42 and directed to the right results in torque which is counterclockwise. This torque is opposed by clockwise torque which is a result of the force which acts on the flow body in front of the rotational axle 42. Depending on the axial position of the rotational axle 42 the difference of these torques can be increased (rotational axle is situated closer to bow 20) or, when the rotational axle 42 is situated in a centre of mass of the wing profile, it can be nearly balanced (rotational axle 42 is closer to hull end 21). The optimal position of the rotational axle 42 depends on the flow speed and of the type of the river-run power plant in which the flow body is used. On increasing flow speed the leading chamber is curved in a more concave manner and the opposite chamber is curved more strongly in a convex manner. This leads to other wing profile shapes with other centre of mass positions. For optimal positioning the rotational axle 42 is connected to the hull 10 via an axially adjustable carriage 43. By means of adjustment of the carriage 43 the rotational

axle 42 can follow the centre of mass displaced by change in profile. If the river-run power plant exclusively uses the rotational movement of the flow body, the rotational axle 42 is situated closer to the hull end 21. If, however, the river-run power plant mainly uses the above-mentioned translatory movement of the flow body, which is then transversally displaceable between the banks of a river, the rotational axle 42 is situated in the centre of mass, as is shown in Figs. 2 to 5c, i.e., on the flow body there is present a near balance of the moments and a maximum lateral force is applied to the rotational axle 42. In Fig. 5a the whole flow body, whose rotational axle 42 is held on a transversally displaceable carriage (not shown), is subjected to a strong resultant force which is directed to the right. The flow body thus moves transversally to the flow without rotating about the rotational axle 42.

When the flow body is to be rotated, for example when it has reached a bank and is to move back to the opposite bank, the working cylinder 36 retracts its piston rod, the toggle joint 40 flips together and the side wall parts move towards one another and into hull 10, as is clearly shown in Figs. 2 and 5b. As soon as the locking bolt 58 disengages from the bore 59 in the leading surface 28, the spoiler flap 30 is freely rotatable about the bow axle 38. The spoiler flap 30 adjusts automatically to direction of flow W. As, however, the leading surface 28, which is curved in a slightly concave manner, is now subjected directly to the flow, there is a dynamic pressure between leading surface 28 and left side wall 34, so that the spoiler flap 30 is rotated further counterclockwise and is no longer precisely symmetrical in the direction of flow W, as is shown in Fig. 5. In this way the water, which would actually flow to the left side wall part 14, can flow to the side wall part 12 through a gap 60 formed in hull 10 between the leading surface 28 and one end of the left side wall 34. The water flowing through gap 60 leads to a break-off of the flow on the

side wall part 12 and thus leads to a high drop in pressure. The flow body begins to rotate counterclockwise. Gap 60 thus closes again and the cylinder 36 is actuated again and nearly stretches toggle joint 40 through (as shown in Fig. 2). A right part of the leading surface 28 is again covered by the left side wall 34 and a left part of the leading surface 28, not yet covered, supports the rapid rotation of the flow body beyond the position which is precisely in the direction of flow W. The volumes of the right and the left chamber 16 and 18 are balanced more and more during the rotation until finally the right chamber 16 has a smaller volume than the left chamber 18. Shortly after the flow body has rotated beyond a position which is precisely in the direction of flow W, the locking bolt 58 is again in the direction of longitudinal plane A and engages. The flow body thus is provided with a shape and position which is mirrored to the representation in Fig. 5a and thus rotates in its end position (Fig. 5c) which is limited by stops 44 and 46 on the rotational axle 42. The flow body is subjected in this position to a force directed to the left and moves back to the opposite bank, wherein the movement processes as explained above take place in reversed order. As soon as the flow body is to rotate again, the spoiler flap 30 as shown in the position in Fig. 5c is actuated again, whereby the side walls 32 and 34 are moved towards each other again and into the hull 10.

The stops 44, 46 are adjustable for setting the maximum angle of rotation α of the flow body, because in the case of an excessive inclined position of the flow body to the flow an excessive bending stress on the whole flow body may occur and thus stall might occur.

In extremely long flow bodies several adjacent chambers 16, 18 are preferable.

In a further embodiment of the flow body, which is not shown in the drawings, the bridge 26 may be part of the

adjusting device 22. For this purpose the bridge, for example, may be arranged in the manner of a "spine", namely, for example, as a chain of mutually supportive joints which can be controlled by two parallel cable lines in such a way that the bridge bends to the one or the other side, whereby it remains stable and may transmit forces. Between the joints spring-resilient bodies can be introduced which ensure that whenever the the cable lines transmit the same force on either side of the joint chain, said joints return to the neutral or initial position. In this case the flow body would be provided with the bow axle 38 as the swivelling axle and the spoiler flap 30 could be omitted.

15 A further probable embodiment of the adjusting device consists in the flow body in that the bridge 26 is provided with a double wall and the intermediate space is filled with an electrostatic liquid which can be stiffened by applying a voltage. The electrostatic liquid becomes
20 rigid by the application of the voltage, it freezes like ice. In this manner the bridge can be optionally made flexible or inflexible by applying a respective voltage.

1. A flow body, in particular for a river-run power plant for utilizing hydromechanical energy, with a hull (10) and a guiding apparatus for guiding the flow body in the water, characterized in that the guiding apparatus consists of shape-changeable side wall parts (12, 14) which outwardly limit at least one inner hollow chamber of the hull (10) and of an adjusting device (22) for adjusting the shape of the side wall parts (12, 14).

2. The flow body as claimed in claim 1, characterized in that the shape of the side wall parts (12, 14) is adjustable by means of the adjusting device (22) in such a way that the hull (10) is provided with a wing profile.

3. The flow body as claimed in claim 1 or 2, characterized in that different wing profiles are adjustable with the side wall parts (12, 14).

4. The flow body as claimed in claim 2 or 3, characterized in that by the shape of each side wall part (12, 14) one side of the wing profile can be arranged as the pressure side and the other side as suction side, and vice-versa.

5. The flow body as claimed in one of the claims 1 to 4, characterized in that the shape-changeable side wall parts (12, 14) are flexible.

6. The flow body as claimed in claim 5, characterized in that the hollow chamber of the hull (10) is provided with at least two opposed lateral chambers (16, 18) whose respective outer sides consist of shape-changeable side wall parts (12, 14) and that the adjusting device (22) may expand or constrict the chambers (16, 18) in a different manner.

7. The flow body as claimed in claim 6, characterized

by a symmetrical T-beam-like structure (24), with a short flange (25) and a long bridge (26) which is situated at a right angle thereto and which extends in a longitudinal plane (A) of the hull (10) between the chambers (16, 18).

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8. The flow body as claimed in claim 7, characterized in that the adjusting device (22) is provided with at least one pneumatic or hydraulic pumping apparatus.

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9. The flow body as claimed in one of the claims 6 to 8, characterized in that the adjusting device (22) for adjusting the shape of the shape-changeable side wall parts (12, 14) is provided with a connecting conduit (52) between the opposed lateral chambers (16, 18).

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10. The flow body as claimed in one of the claims 6 to 9, characterized in that the chambers (16, 18) consist of folding bellows.

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11. The flow body as claimed in one of the claims 1 to 10, characterized in that at least one spoiler flap (30) is provided on the bow (20) of the hull (10) for changing the flow on the side wall parts (12, 14).

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12. The flow body as claimed in claim 11, characterized in that the spoiler flap (30) is swivellable about at least one bow axle (38), so that the flow is deflectable from the one side of the hull (10) through the hull (10) to the other side wall part (12, 14) on the other side of the hull (10).

30

13. The flow body as claimed in claim 11 or 12, characterized in that the spoiler flap (30) consists of two opposed outer side walls (32, 34).

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14. The flow body as claimed in claim 13, characterized in that the side wall parts (32, 34) are swivellable towards one another and away from one another about the bow axle (38).

15. The flow body as claimed in one of the claims 11 to 14, characterized by a control device (36) for swivelling the spoiler flap (30).

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16. The flow body as claimed in claim 15, characterized in that the side walls (32, 34) are connected via a toggle joint (40) to one another which is actuatable through the control device (36).

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17. The flow body as claimed in claim 15 or 16, characterized in that the control device (36) comprises a hydraulic or pneumatic working cylinder.

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18. The flow body as claimed in claim 5, characterized in that the shape-changeable side wall parts (12, 14) of the hull (10) consist of polycarbonate reinforced by glass fibres.

20

19. The flow body as claimed in one of the claims 11 to 17, characterized by a leading surface (28) arranged transversal to the hull (10) behind the spoiler flap (30), which surface can be flowed on when the spoiler flap (30) is actuated.

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20. The flow body as claimed in one of the claims 1 to 19, characterized in that the hull (10) is attached to a rotational axle (42) whose position is adjustable in the longitudinal direction of its cross section.

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21. The flow body as claimed in claim 20, characterized in that stops (44) which are adjustable on the rotational axle (42) are attached in such a way that owing to these a maximum angle of rotation α of the hull (10) is adjustable.

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22. The flow body as claimed in claim 20 or 21, characterized in that the rotational axle (42) is adjustable in the longitudinal direction of the cross section of the

hull (10) in such a way that an approximate balance of moments prevails in the flow body at a maximum angle of rotation α of the hull (10).

- 5 23. The flow body as claimed in one of the claims 1 to 22, characterized in that the shape-changeable side wall parts (12, 14) at the end (21) of the hull (10) are displaceable in a positive guiding means (50).

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Fig. 1

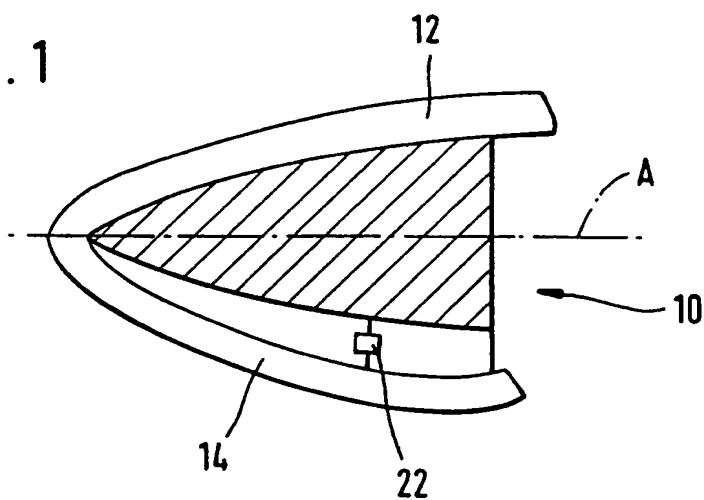


Fig. 2

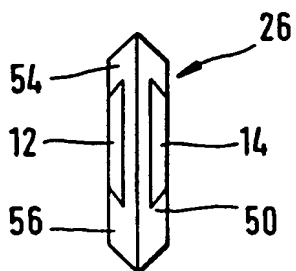
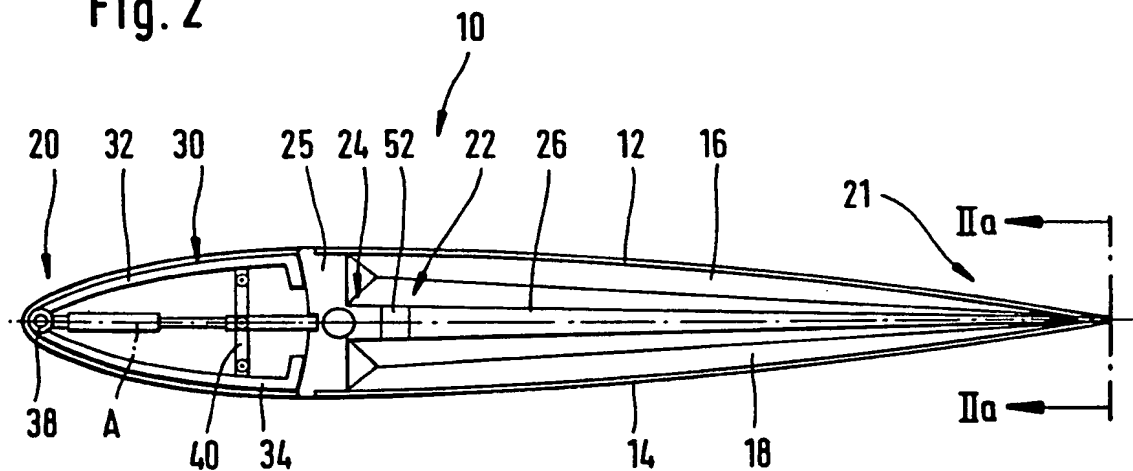
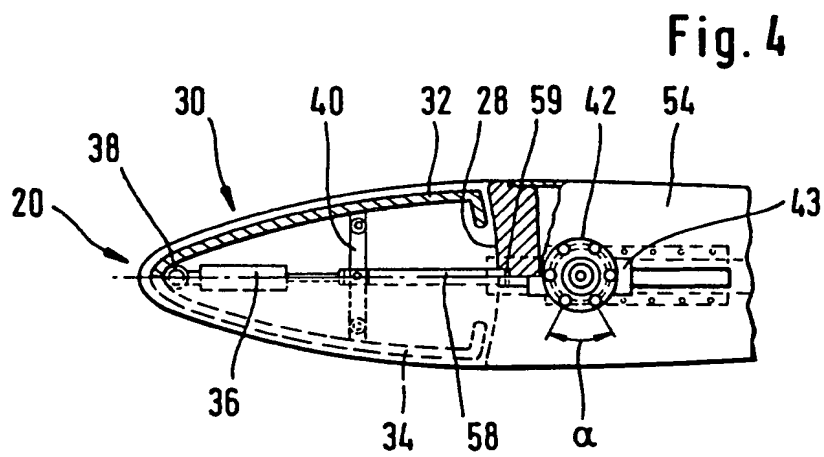
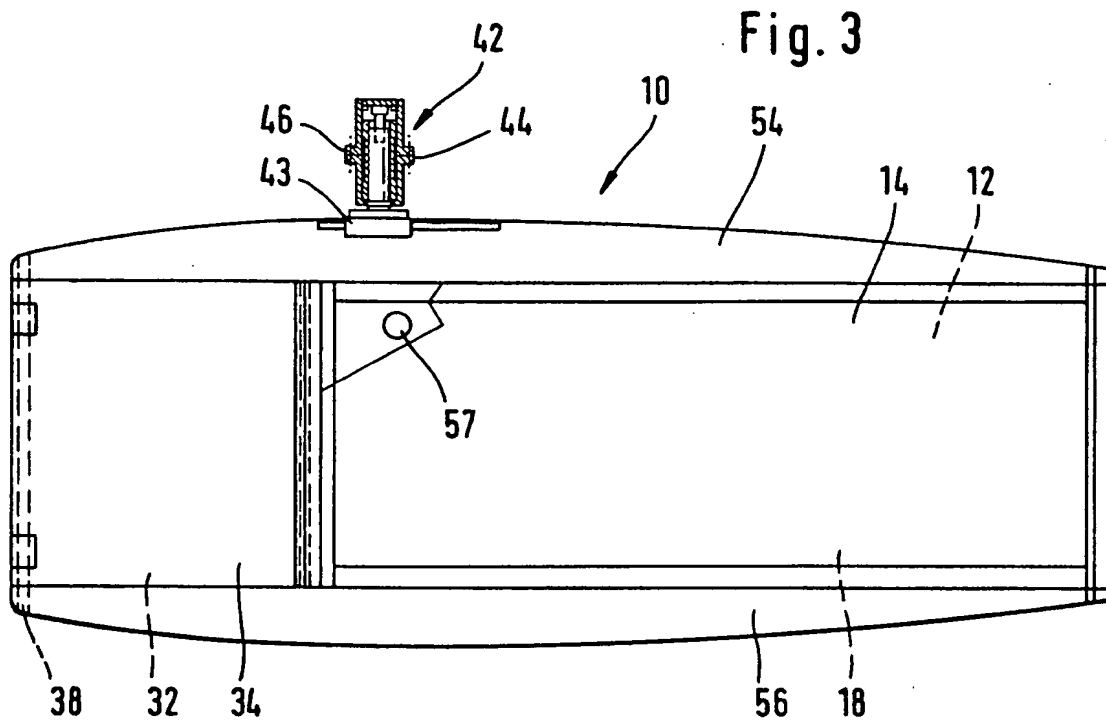


Fig. 2a

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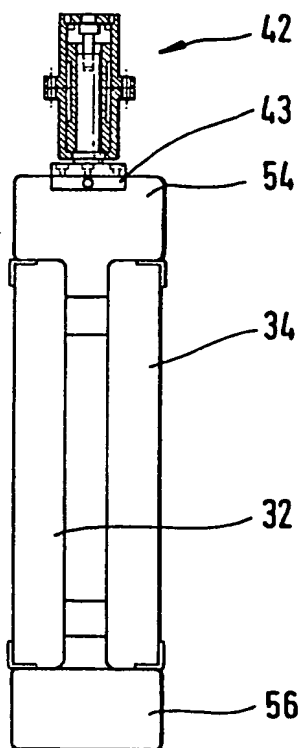


Fig. 3a

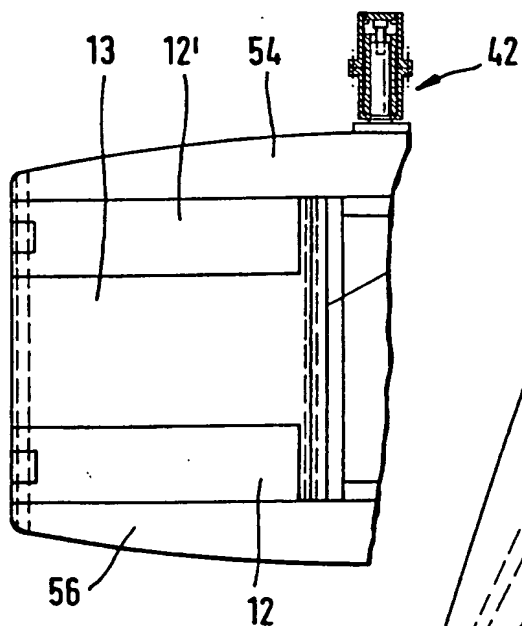


Fig. 3b

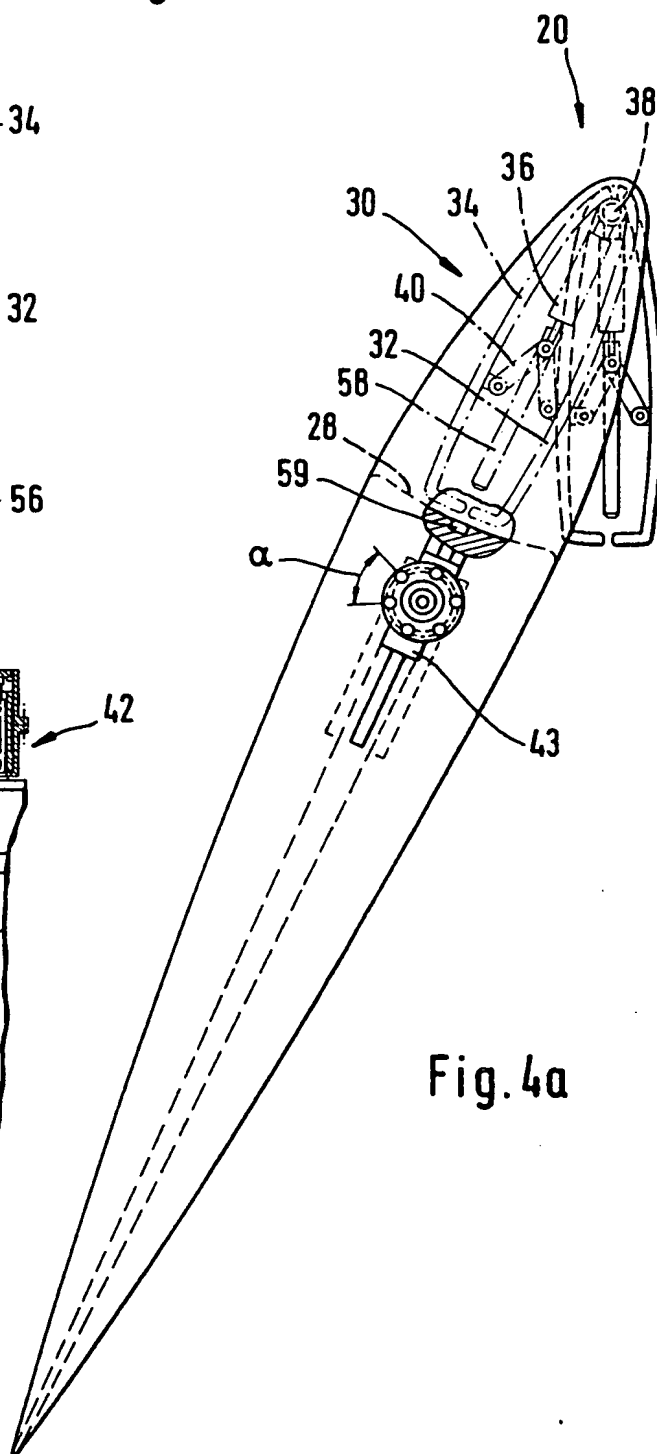


Fig. 4a

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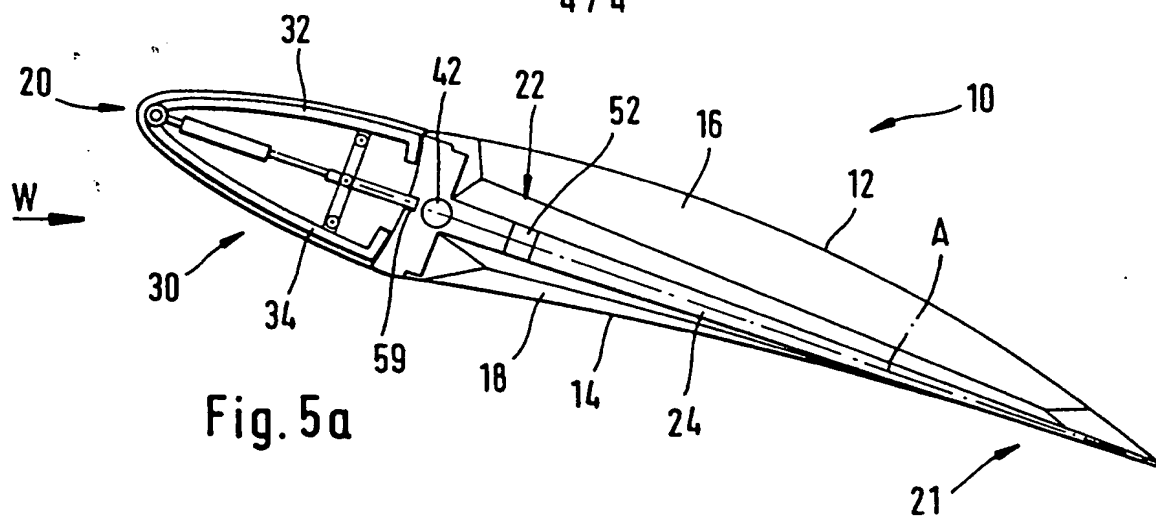


Fig. 5a

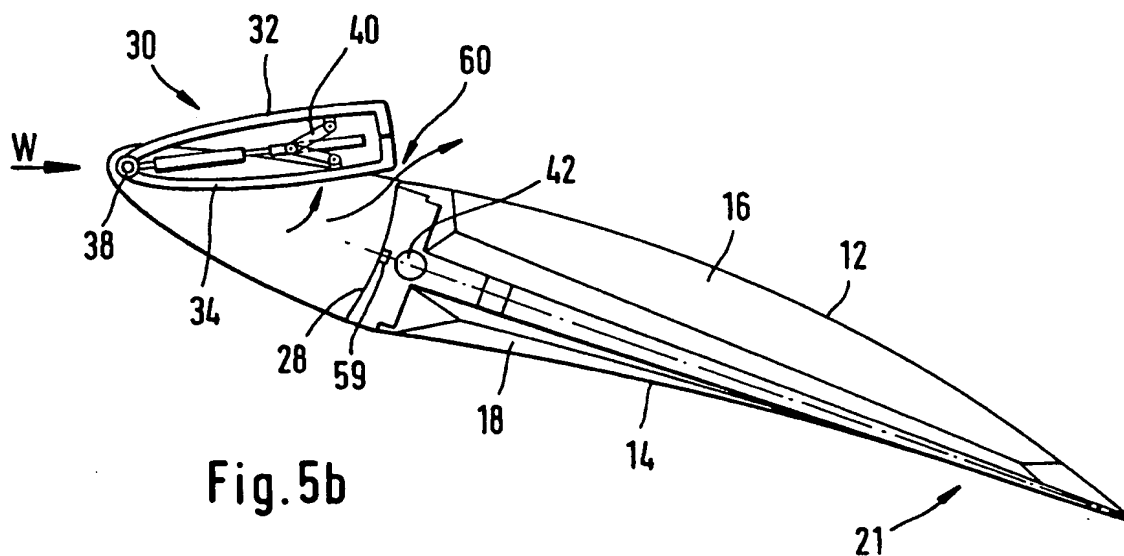


Fig.5b

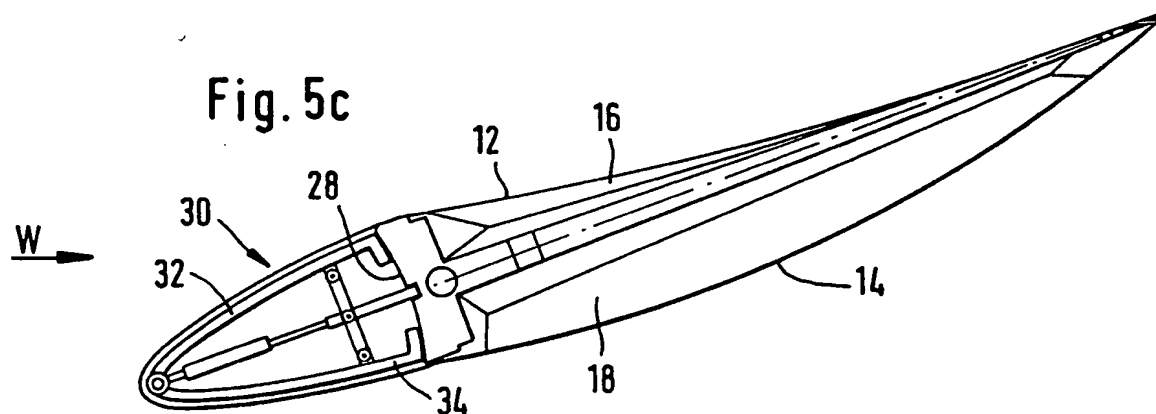


Fig. 5c